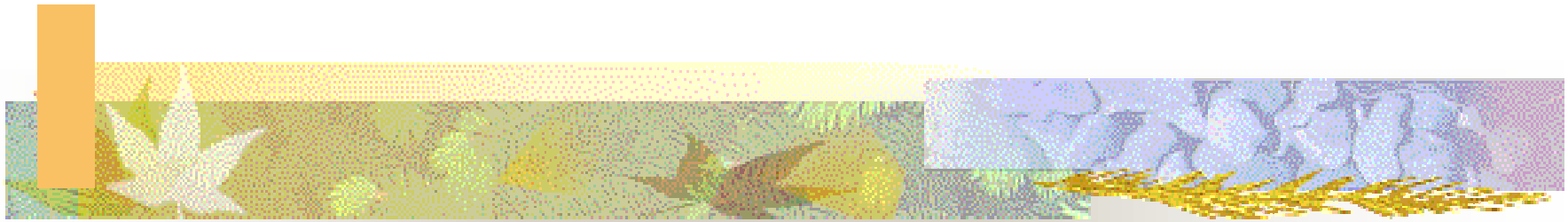
EMAP
Strategic Monitoring: Directions and Challenges

Steve Paulsen



EMAP Symposium 2002 – Kansas City

The Condition of Our Nation's Streams and Rivers from the Mountains to the Coasts

EPA's Mission

Questions About Our Mission

- Are We Making Progress?
  - Now known as GPRA
- Where Can We Make a Difference? (Resource Allocation)
  - Strategic Planning
  - Ecosystem Targeting - Community Based Protection
  - Ranking of Stressors
- Right to Know
  - Effective Assessments
  - Information & Data Availability

Impetus for EMAP

- ***"What do you mean you don't know how many acid lakes there are?"***
  - William Ruckelshaus - EPA Administrator - early 1980s

- ***"Good News - Based on my years in the environmental movement, I think the Agency does an exemplary job of protecting the nation's public health and quality of the environment."***

- ***"Bad News - I can't prove it."***
  - William Reilly - EPA Administrator - 1989

EMAP Objectives

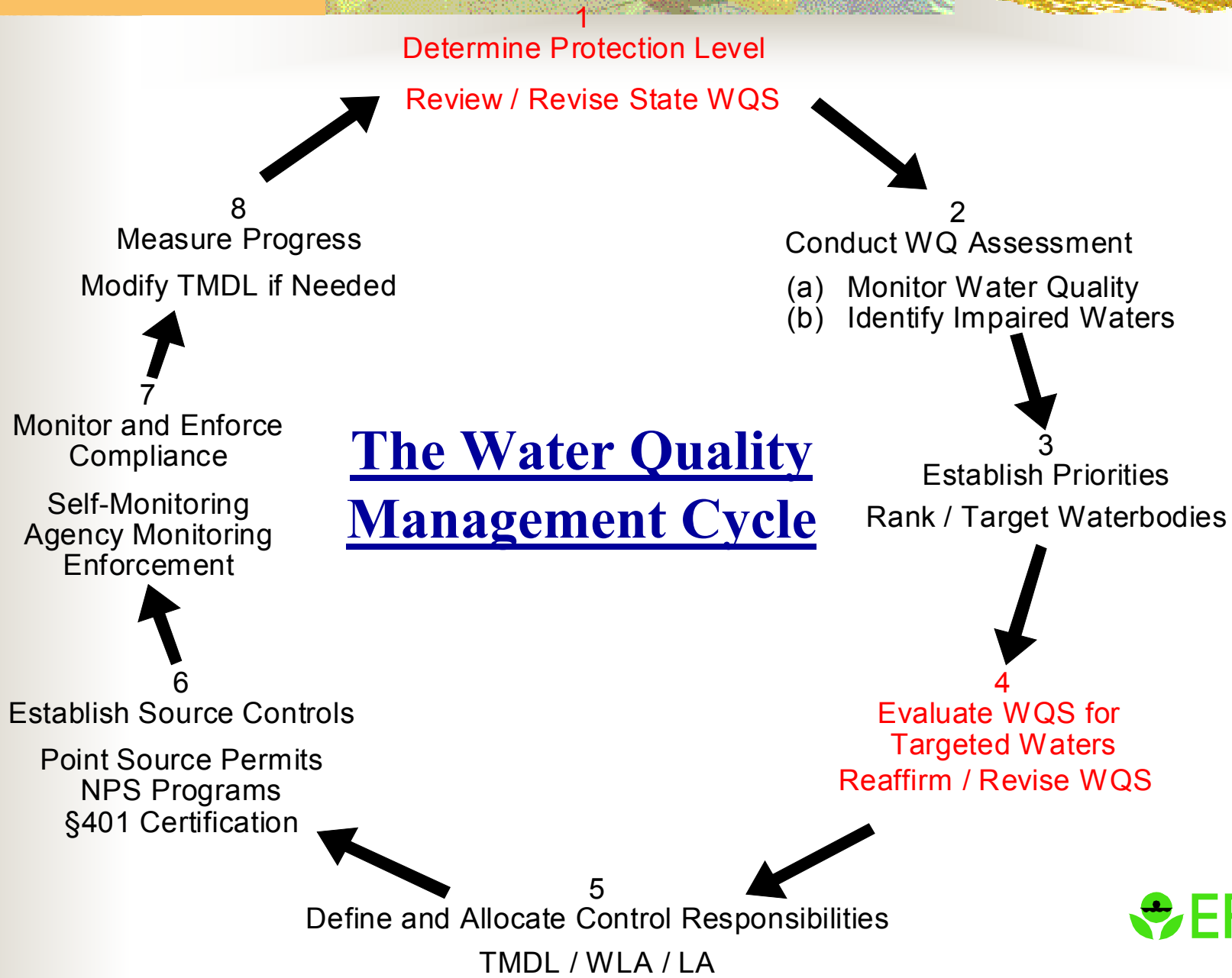
- Status and Trends in Indicators of Condition
- Associations between Indicators of Condition and Indicators of Stressors
- Effective Reporting

Monitoring and Assessment to Impact Priorities Contribute to Decisions on Resource Allocation

Strategic Monitoring

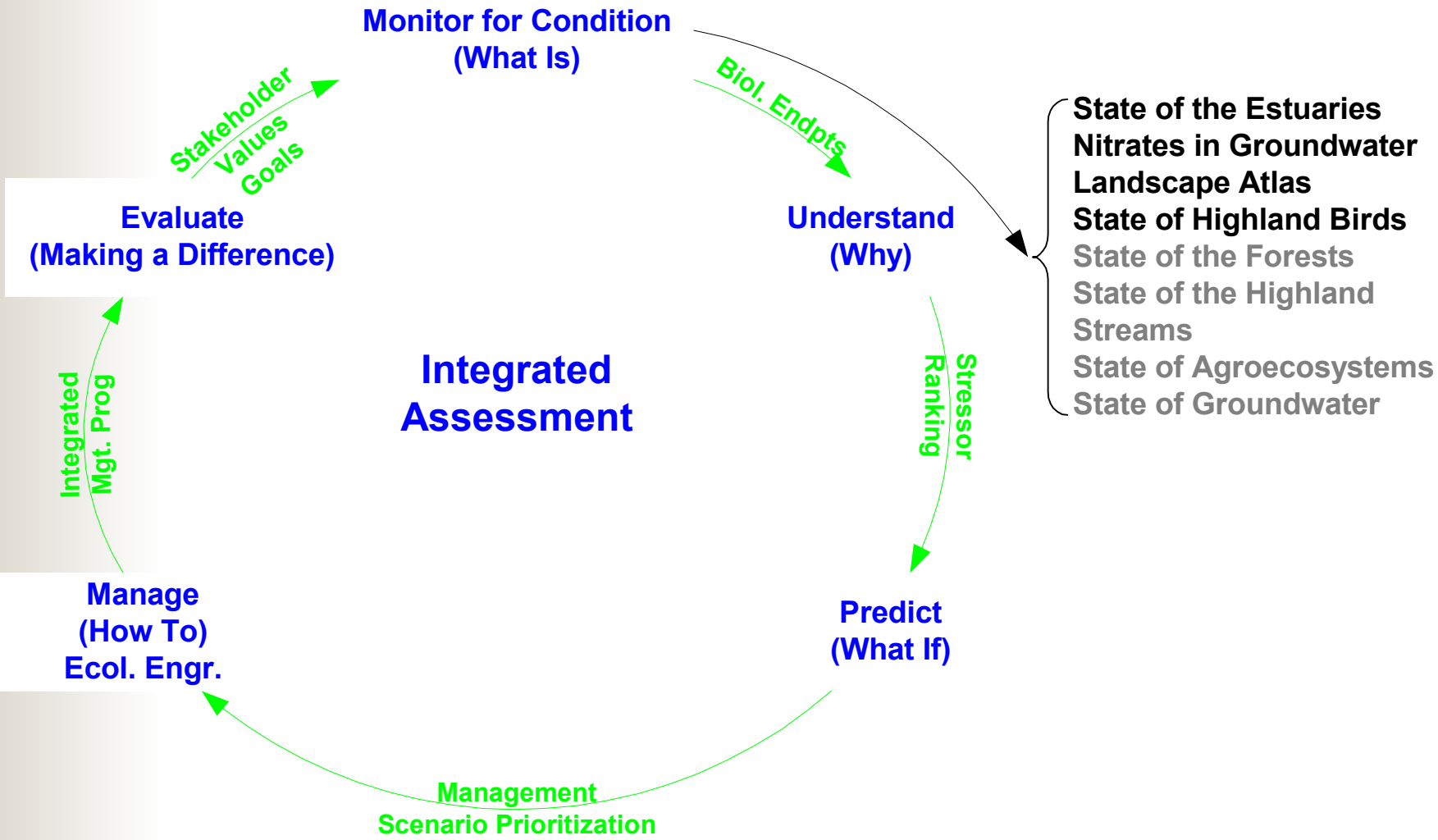
- Do I have a problem?
  - How big and where?
- What are the causes of the problems?
  - Am I worrying about the right things?
- How do I fix it?
- Have the fixes resulted in improvements?
- What can I continue or do differently to improve the resource?

The Water Quality Management Cycle

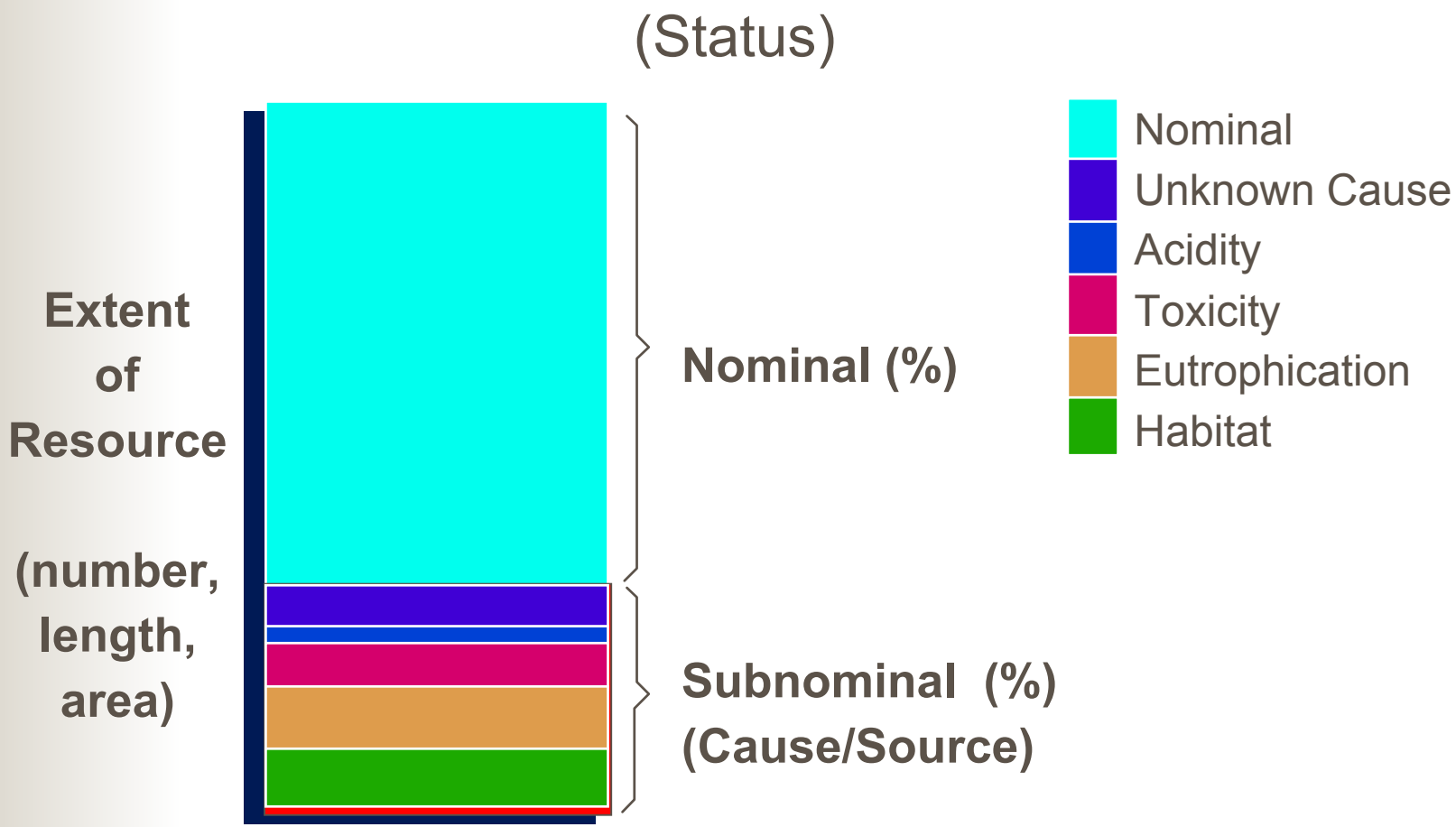


EPA

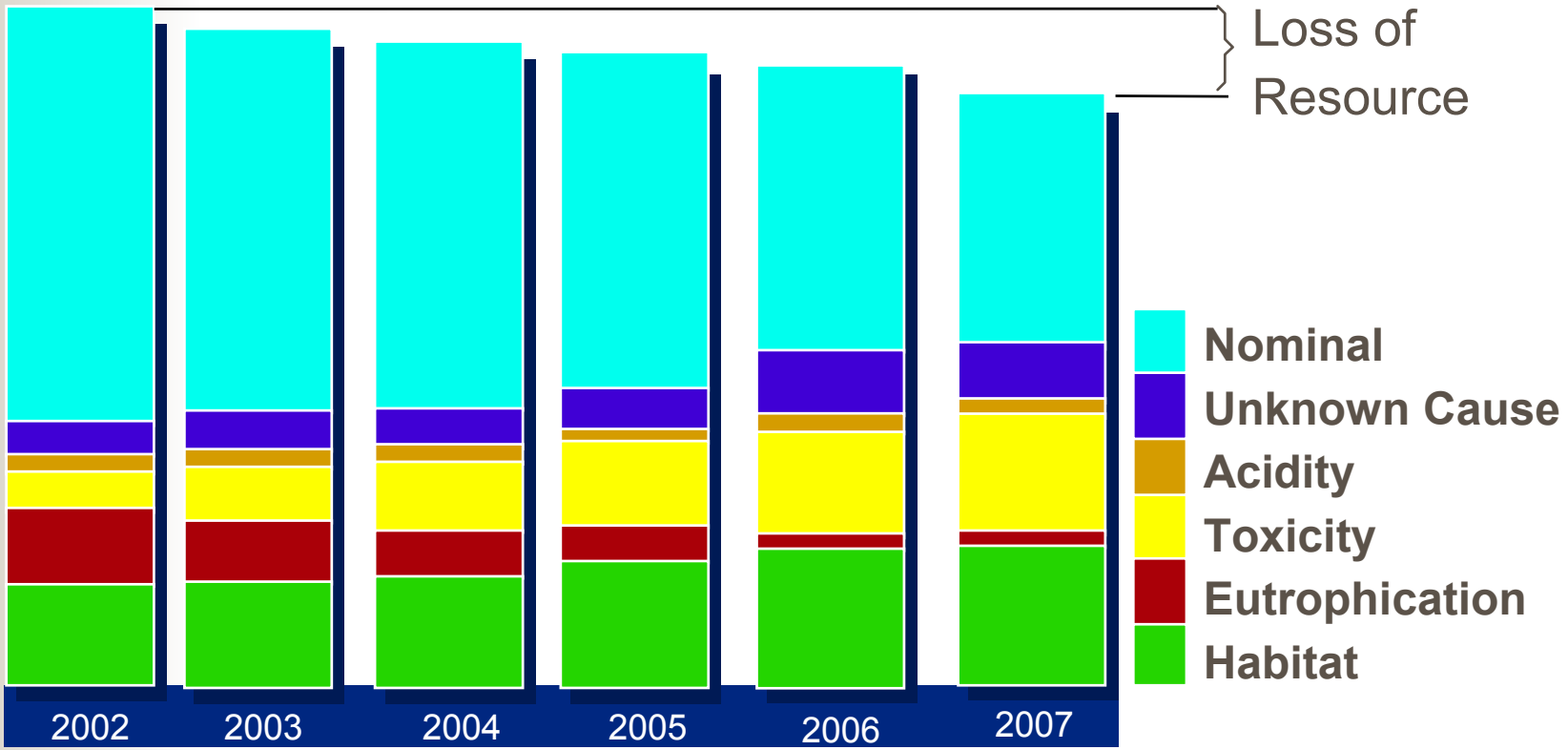
MAIA Assessment & Management: Coming Full Cycle



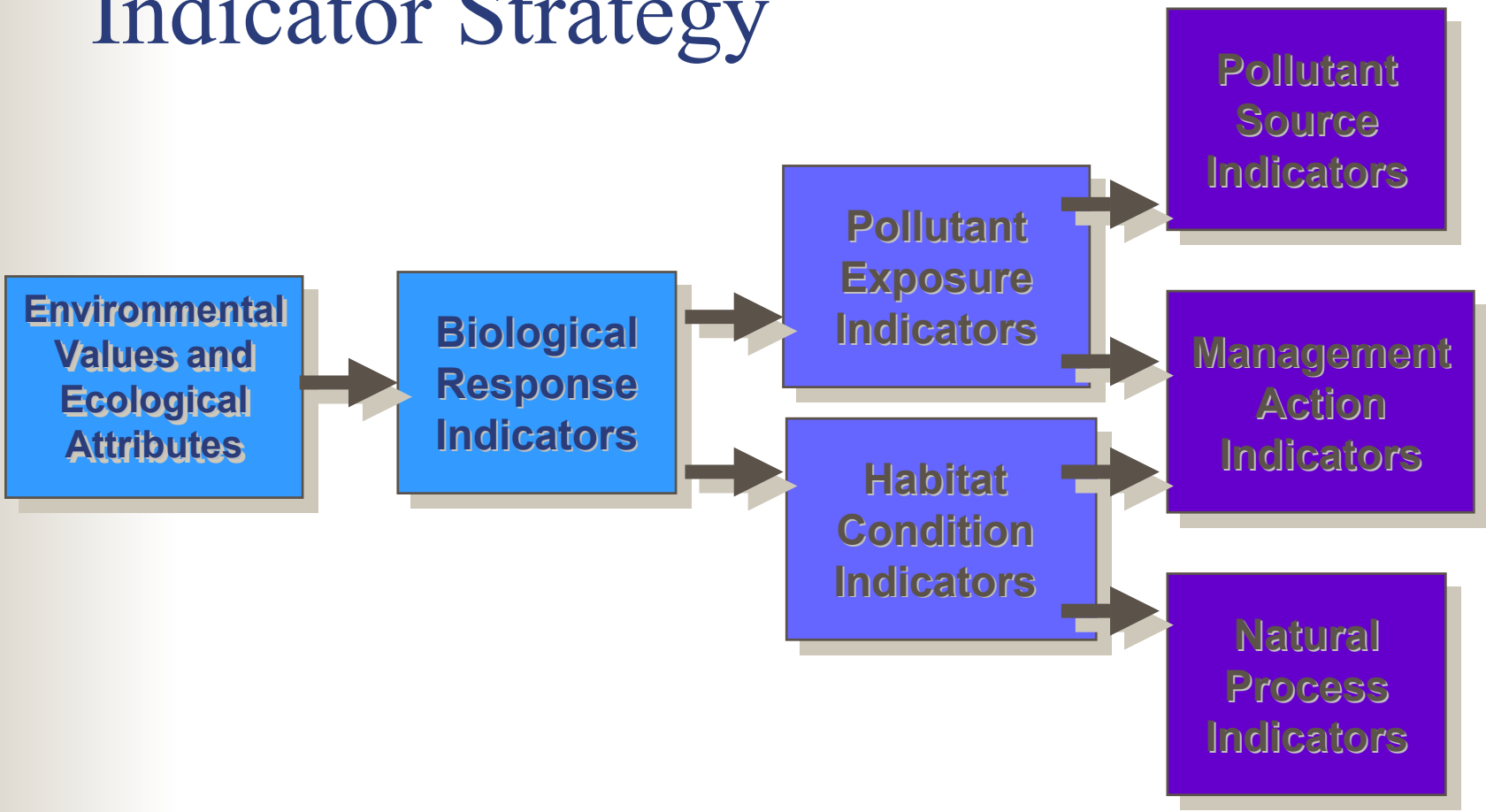
Status & Associations Questions



Regional Trend Questions



Approach Used
Indicator Strategy

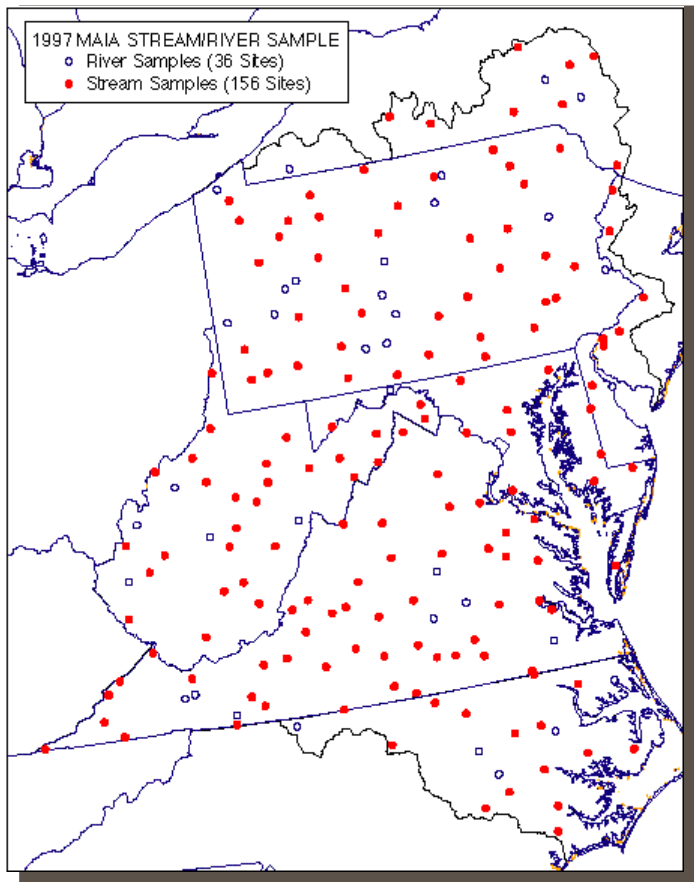


Approach Used

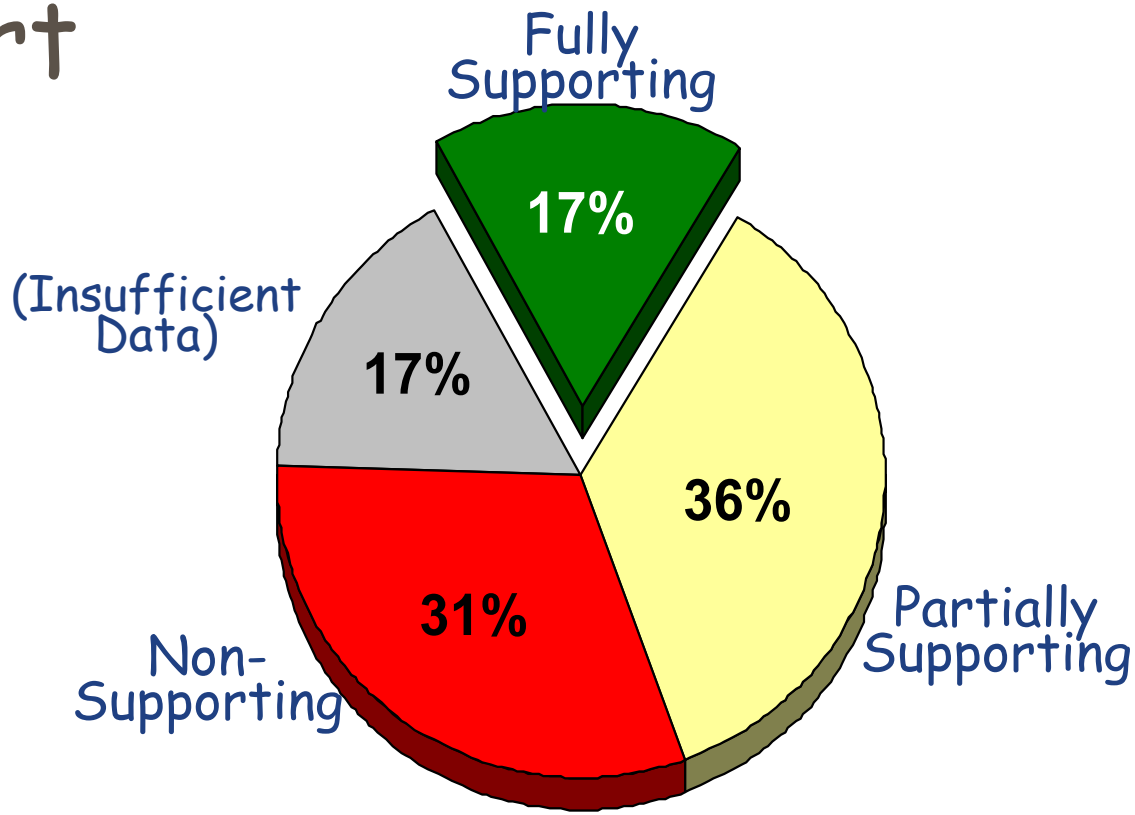
Sample Survey Designs

Stratified Random Sampling

- Simple Concepts of Sampling
- Allows Description of the Whole by Only Sampling Parts
- Used in All Economic Surveys
- Used in All Terrestrial Surveys
- Not Used in Any of National Aquatic Monitoring Programs



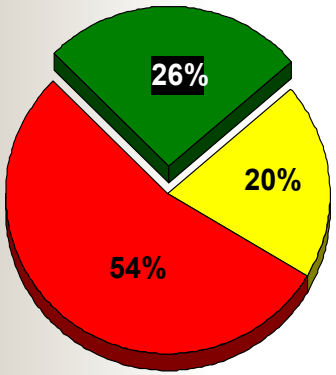
Assessment of Aquatic Life Use Support



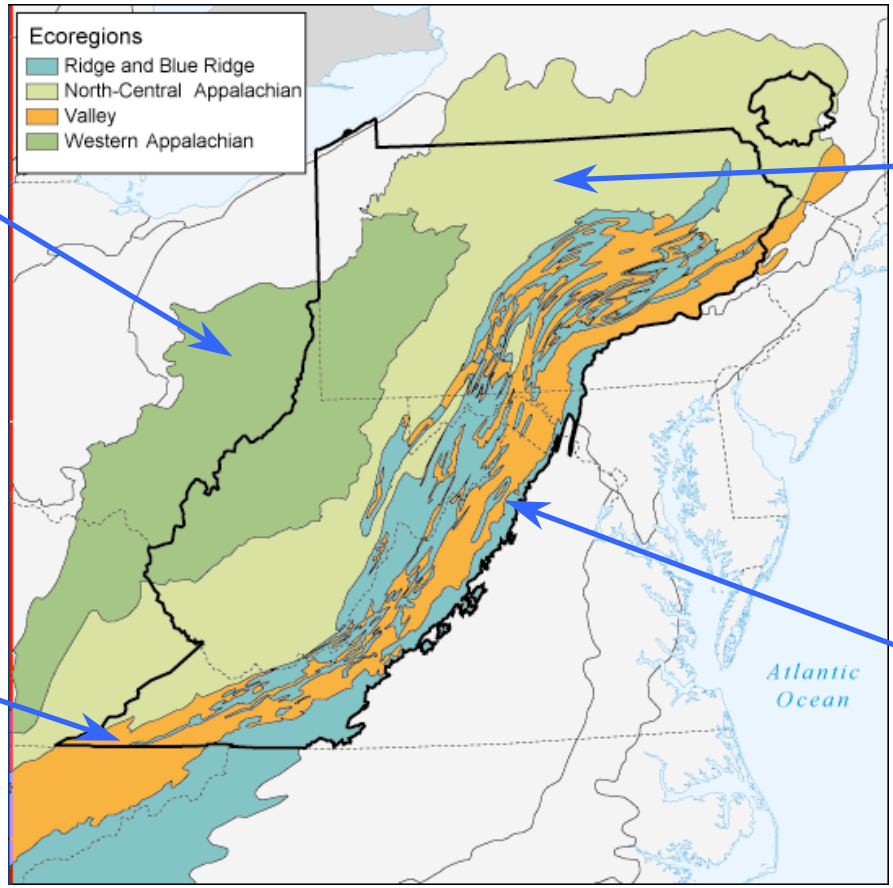
Proportion of Stream Length

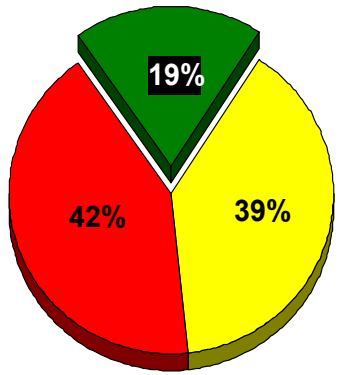
MAHA Results: Aquatic Life Use Support

Ecoregion Patterns

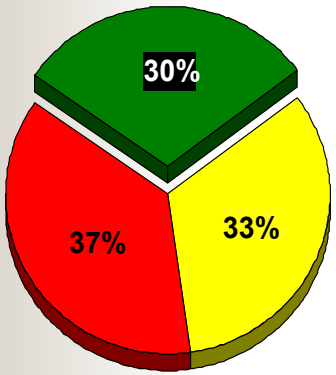


Western Appalachians

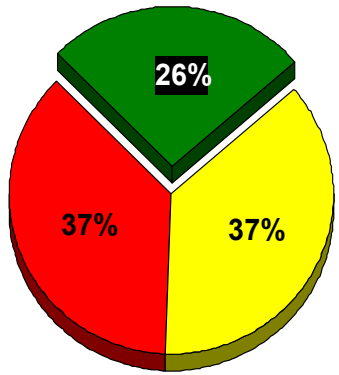




North-Central Appalachians

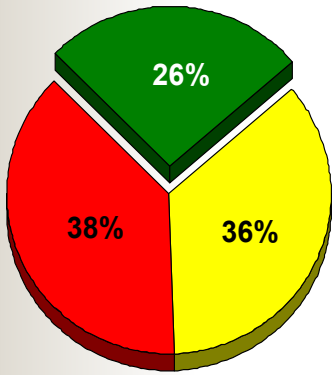


Valleys

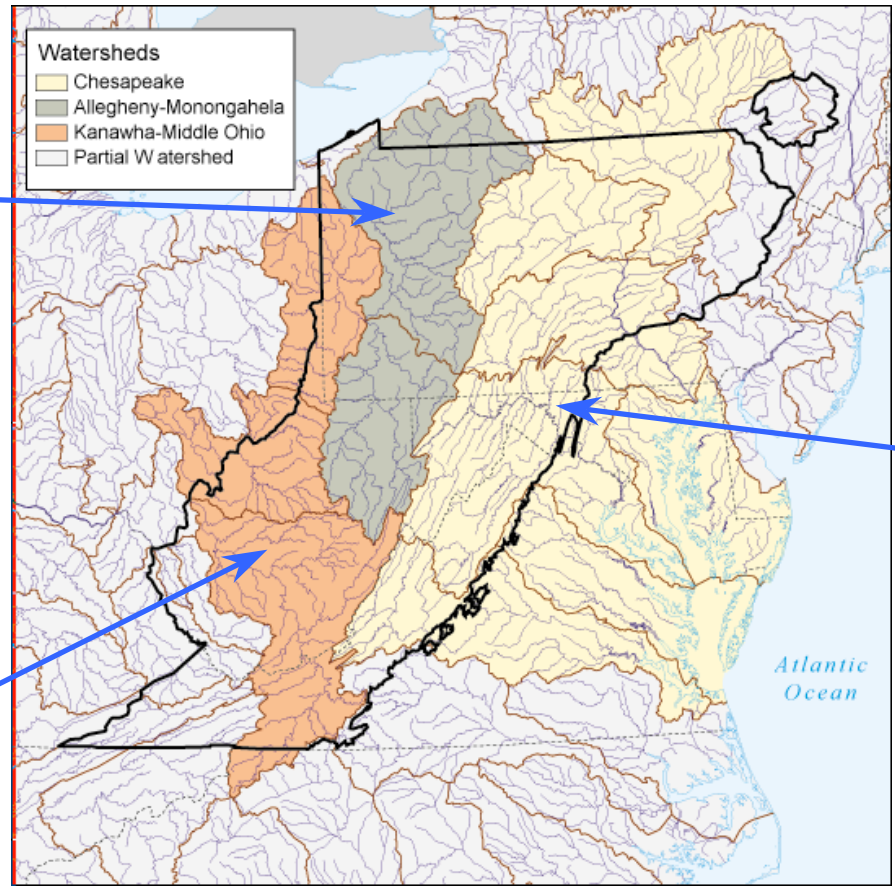


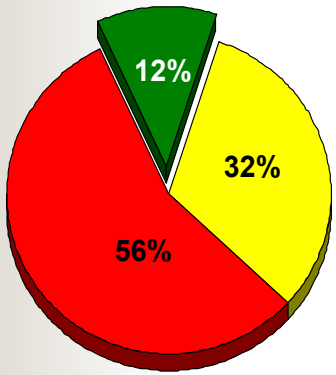
Ridge and Blue Ridge

MAHA Results: Aquatic Life Use Support Watershed Patterns

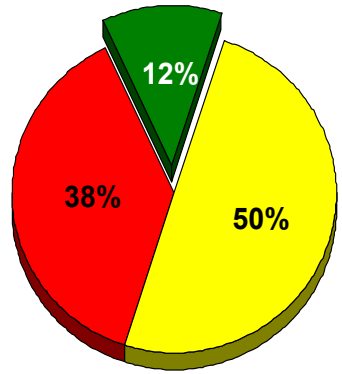


Allegheny-Monongahela



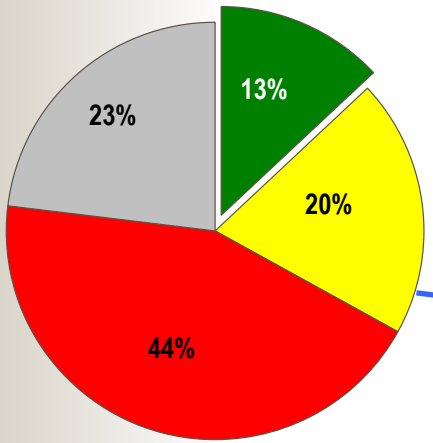


Kanawha-Middle Ohio

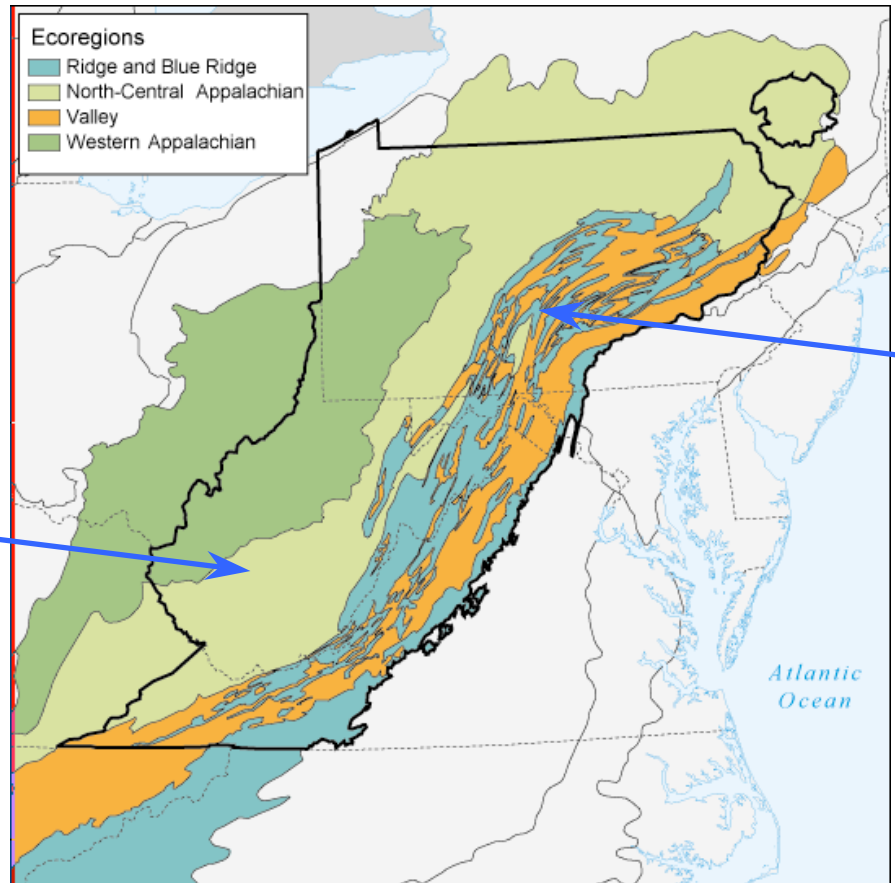


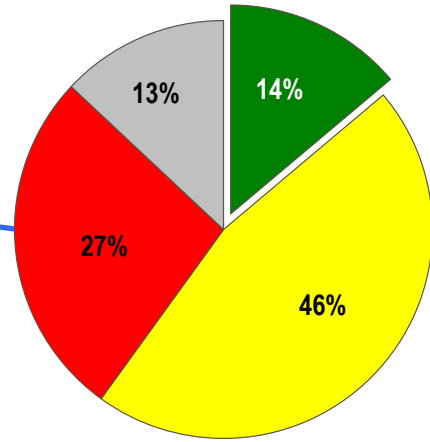
Chesapeake

MAHA Results: Aquatic Life Use Support State Patterns



West Virginia

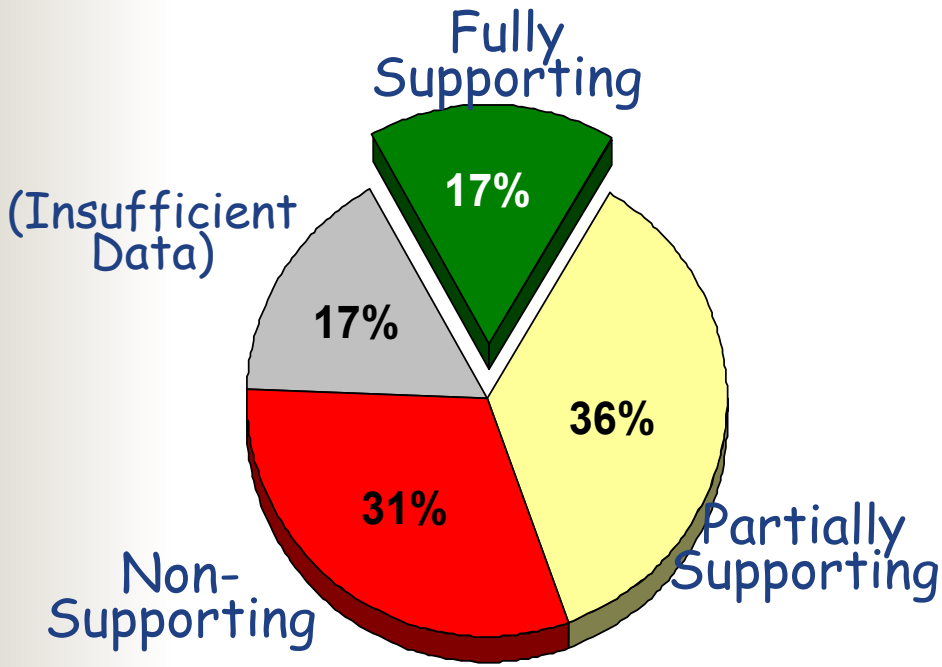




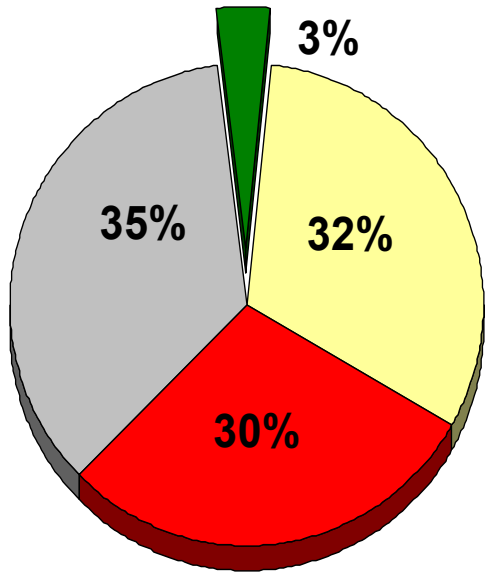
Pennsylvania

Geographic Targeting

Aquatic Life Use Support in Western Appalachian Plateau



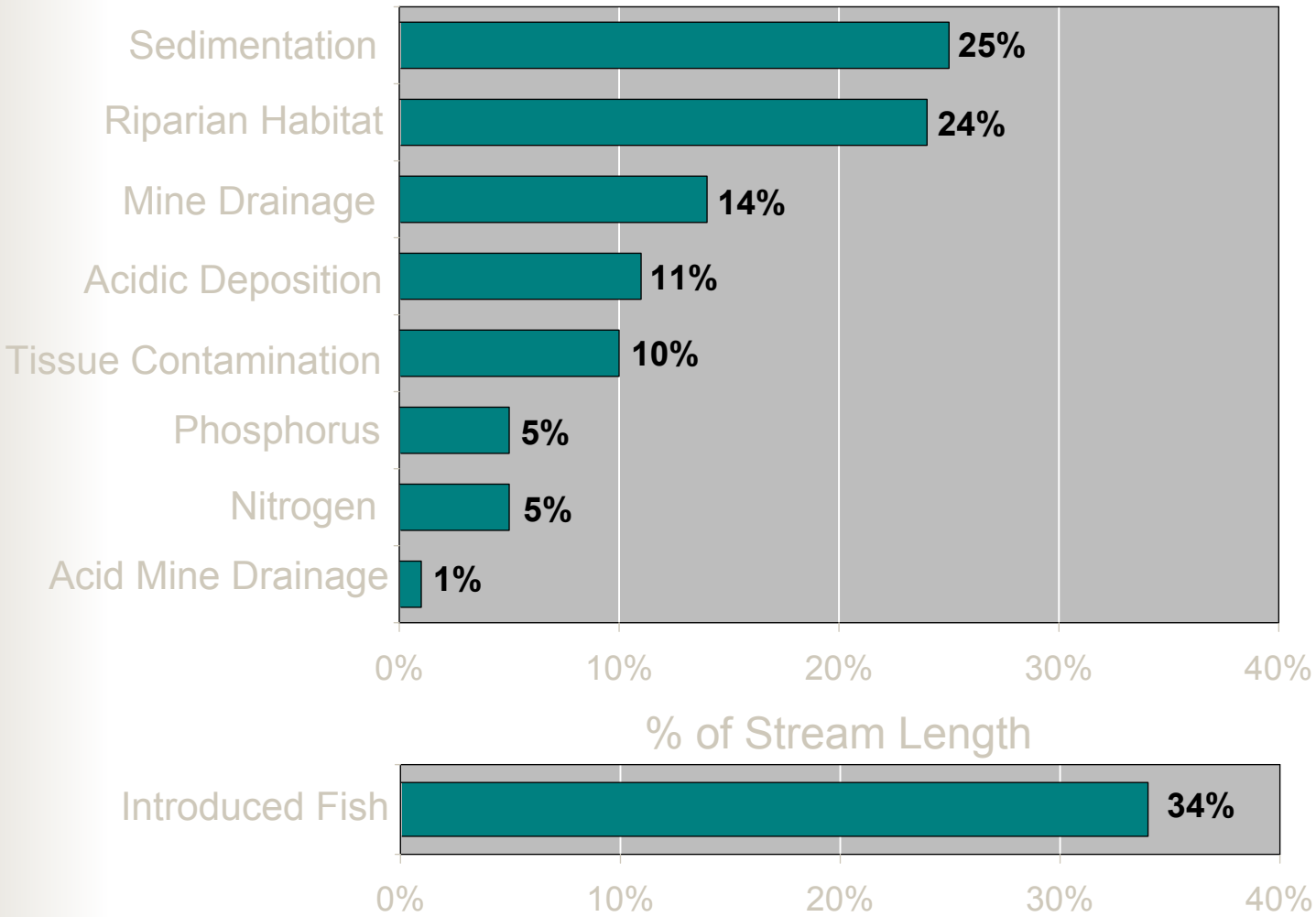
Entire Region



Western Appalachian

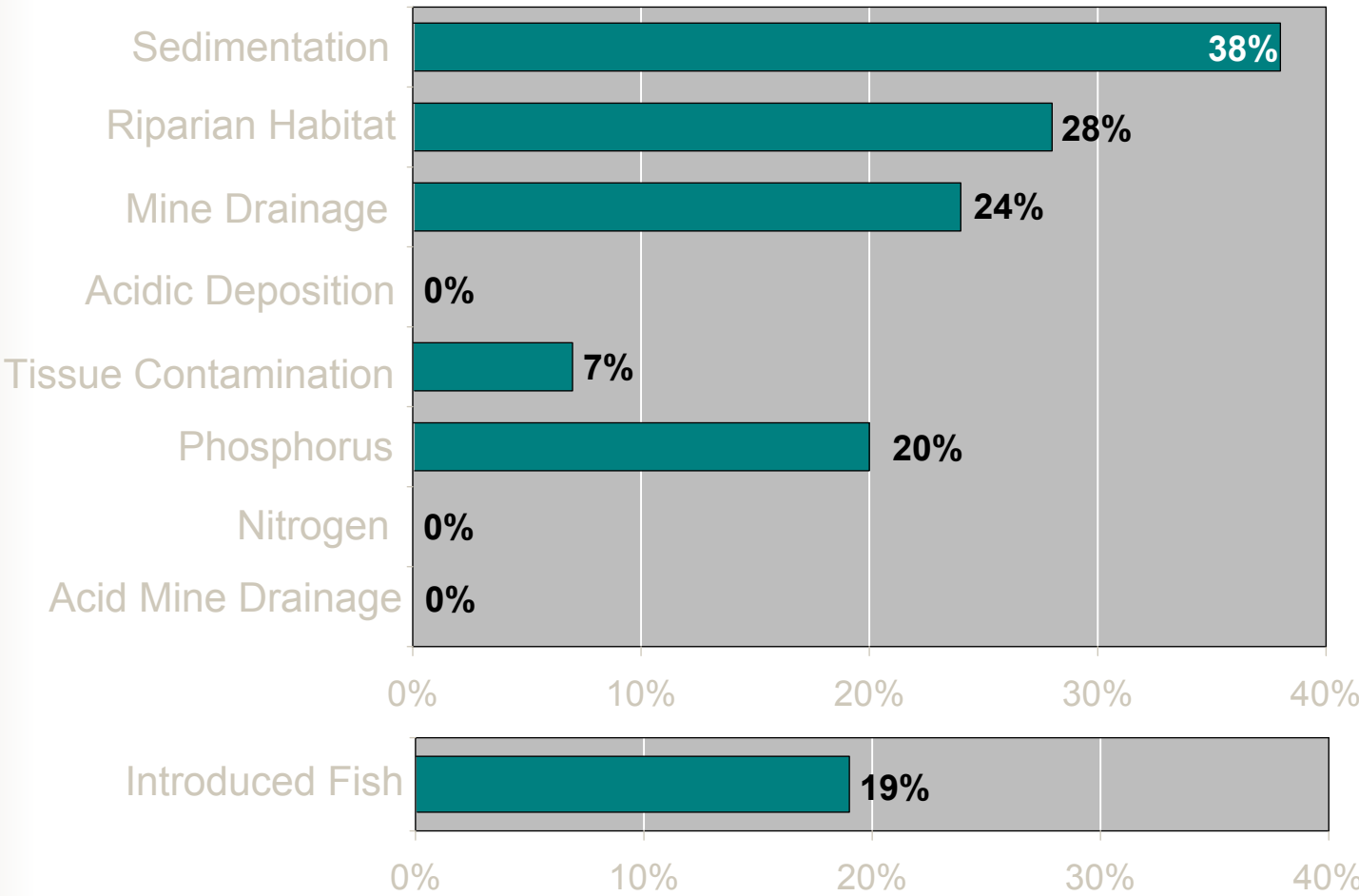
% of Stream Length

Relative Ranking of Stressors



Geographic Targeting

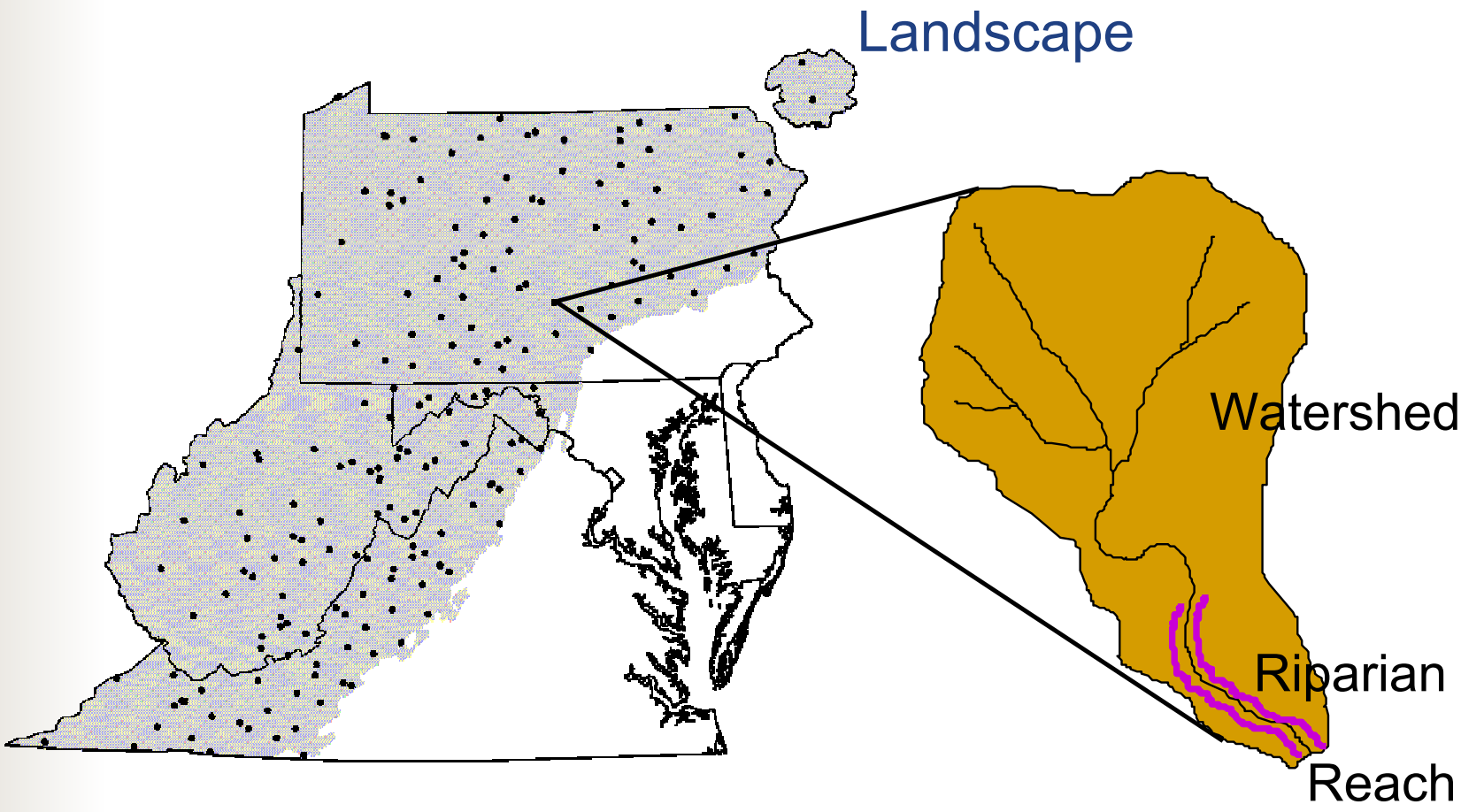
Stressor Ranking-Western App. Plateau



Conscious Decisions Made

- Use biological data to describe condition
- Use chemical, physical, biological, watershed data to get at “causes”
- Separate survey and plot design issues
- Describe all systems but don’t census
- Characterize resource as linear
- Use watershed concepts
- Maintain ability to analyze by different “regionalization schemes”
- Geographic targeting
- Layer multiple survey needs
- Multiple plot scale designs are necessary

MAHA Study Design: Sampling Design

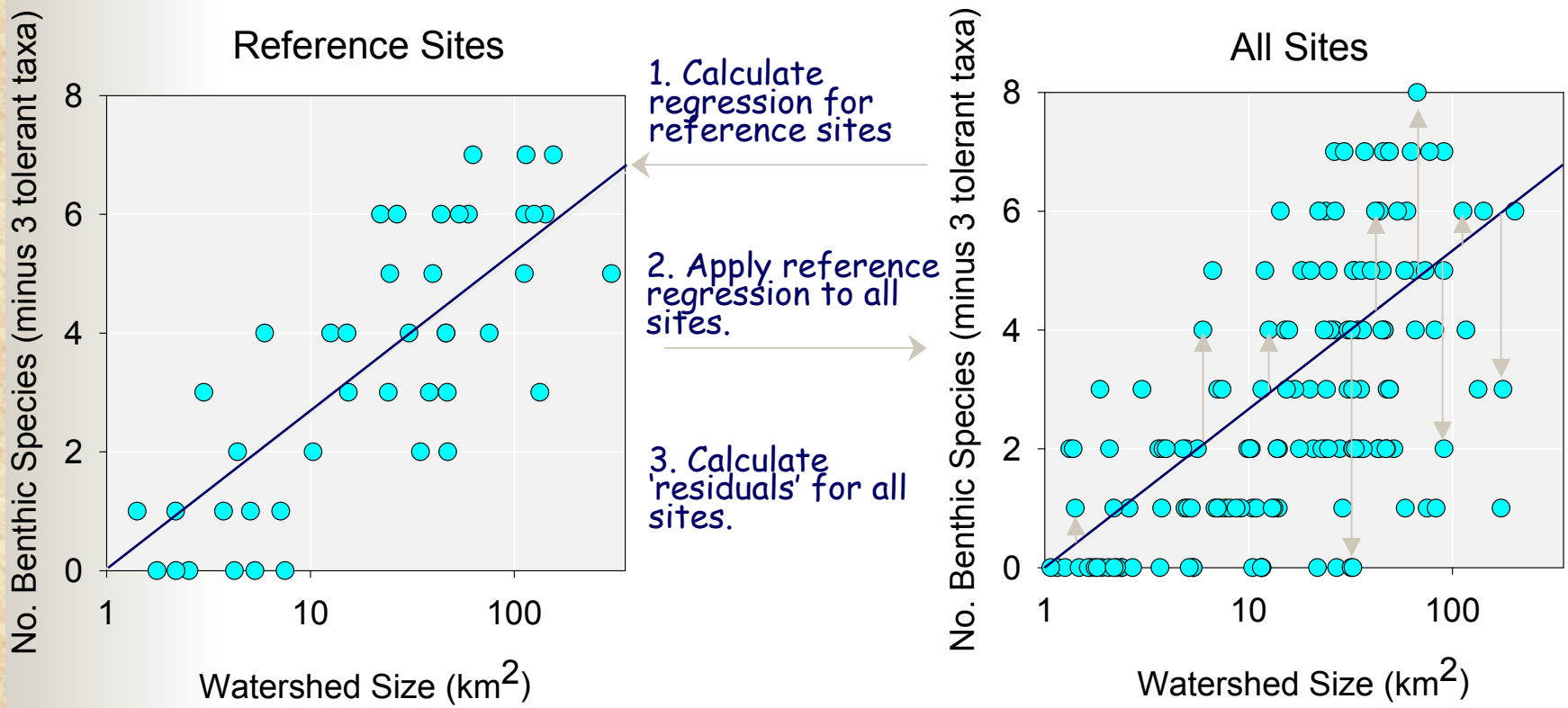


Indicators

- Comparability in Index Development
- Reference Conditions
- Condition and Stressor Indicators for Great Rivers, Wetlands, Lakes
- Integrating Remoting Sensing Tools
- Understanding Variability

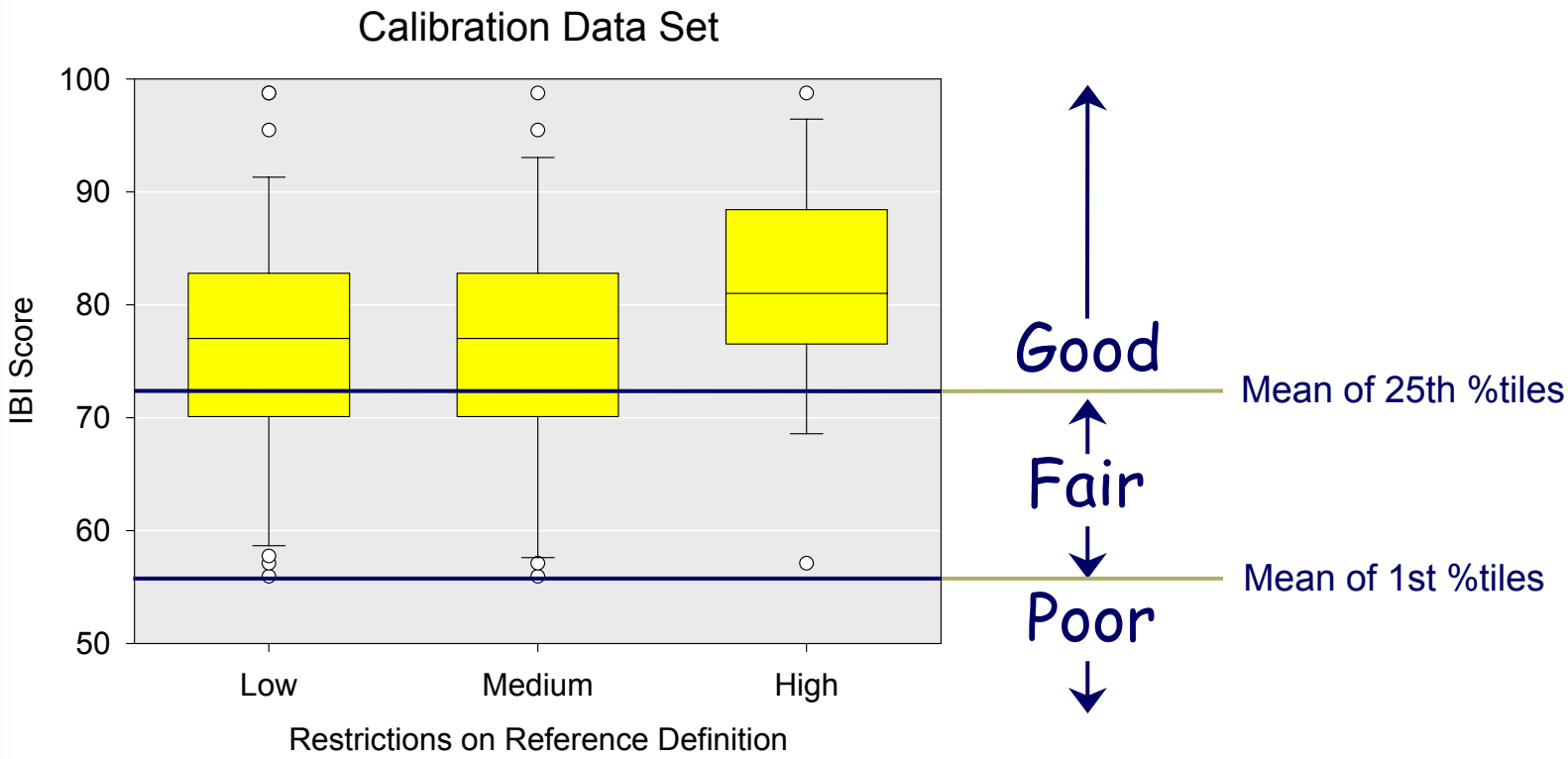
Watershed Correction

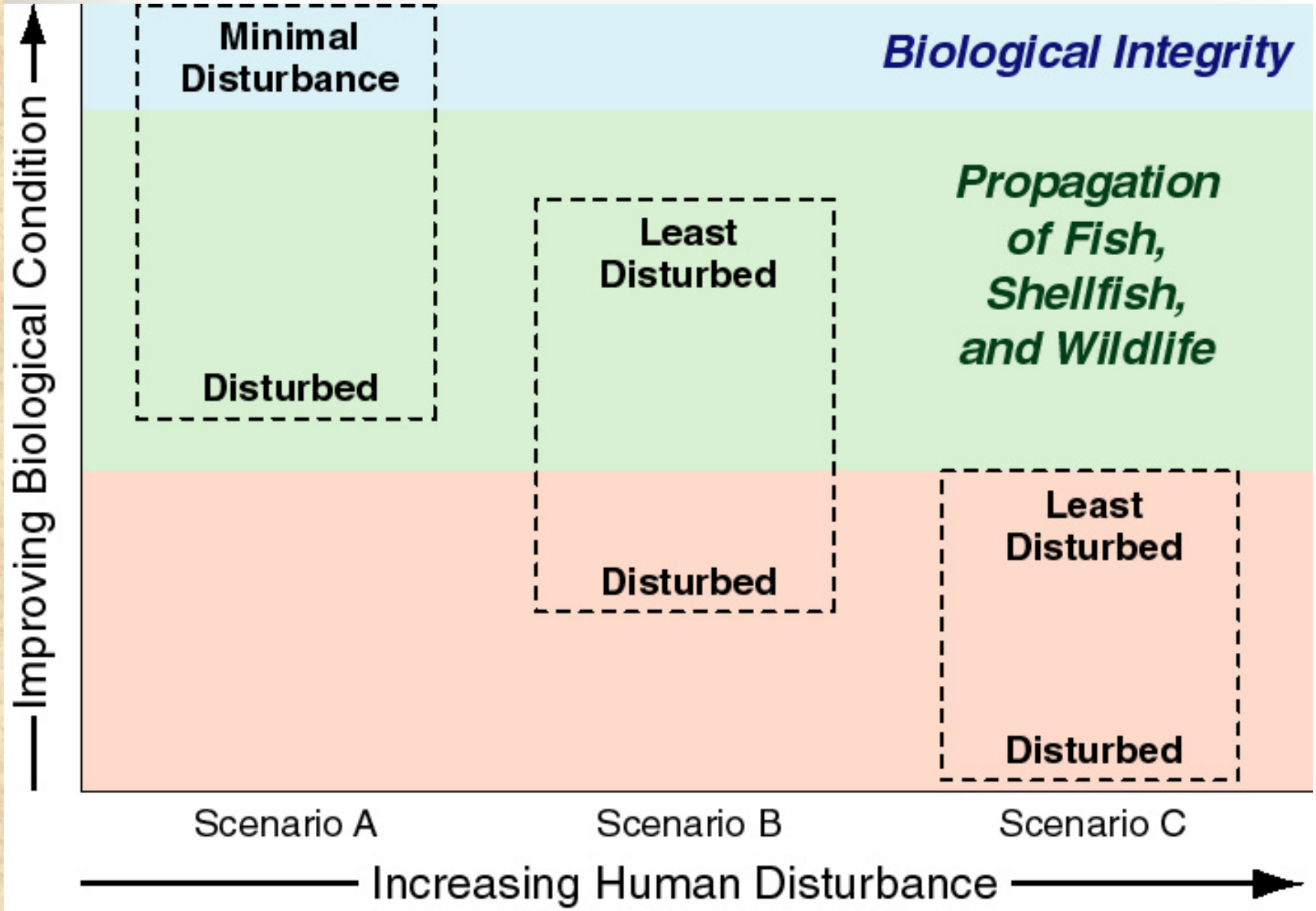
Approach: Use relationships observed at reference sites to define 'natural' element of watershed size effect



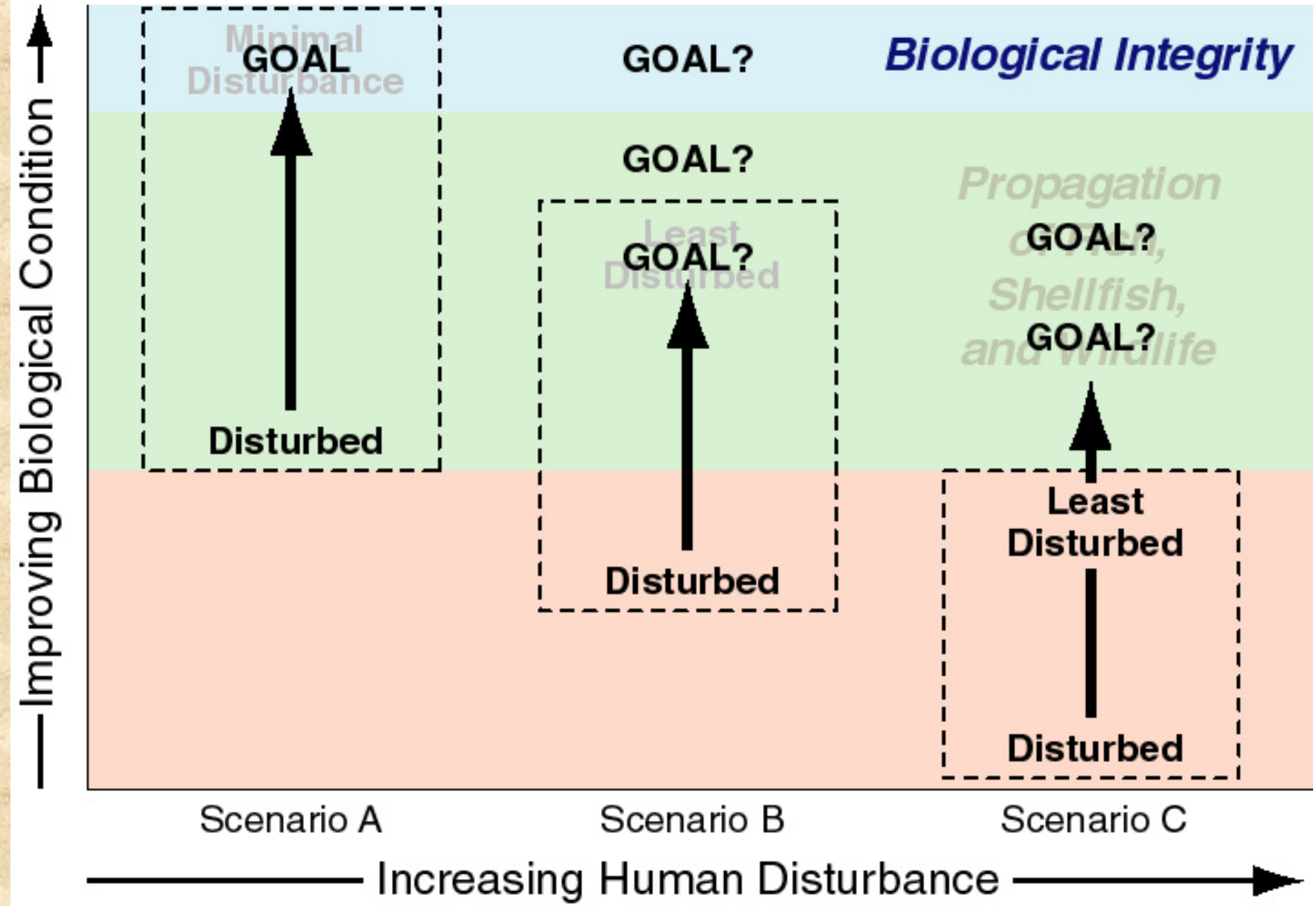
IBI Thresholds

Solution? Use information from all 3 reference definitions to set thresholds - acknowledge uncertainty involved in any one definition

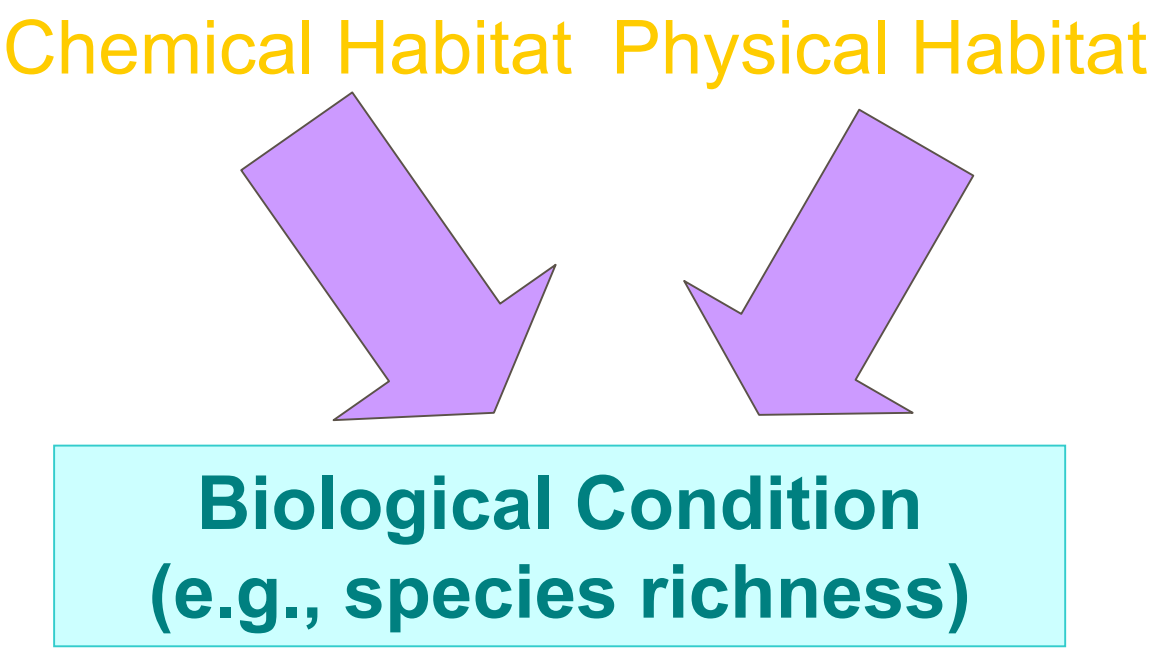



Minimal Disturbance
Disturbed
Biological Integrity
Propagation of Fish, Shellfish, and Wildlife
Least Disturbed
Disturbed
Least Disturbed
Disturbed
Improving Biological Condition
Scenario A
Scenario B
Scenario C
Increasing Human Disturbance

Biological Attainability



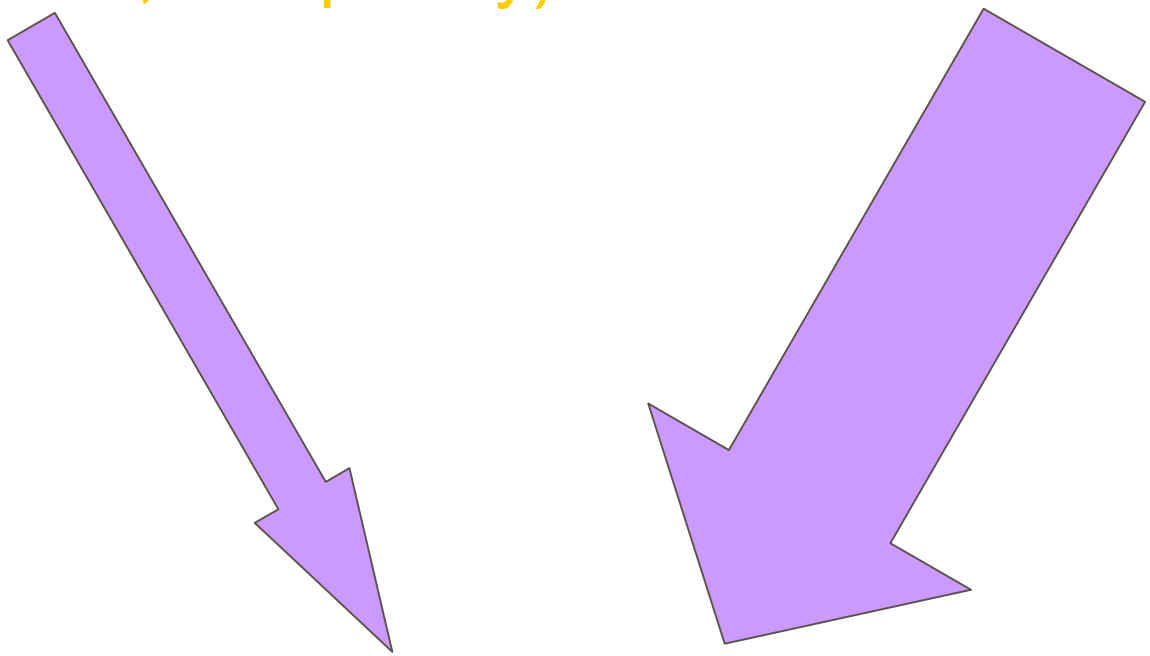
Accounting for Natural Variation



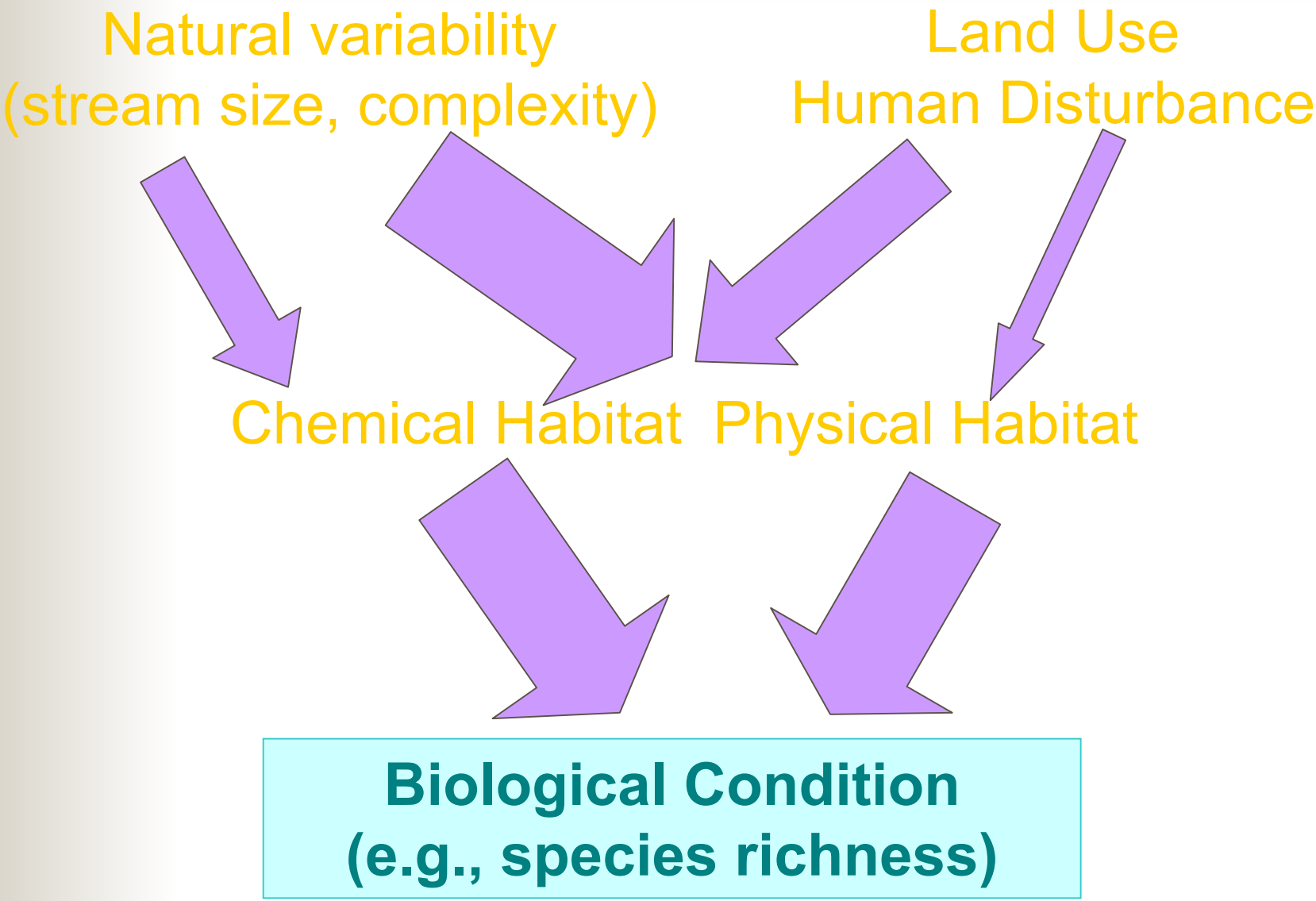
Accounting for Natural Variation

Natural variability
(stream size, complexity)

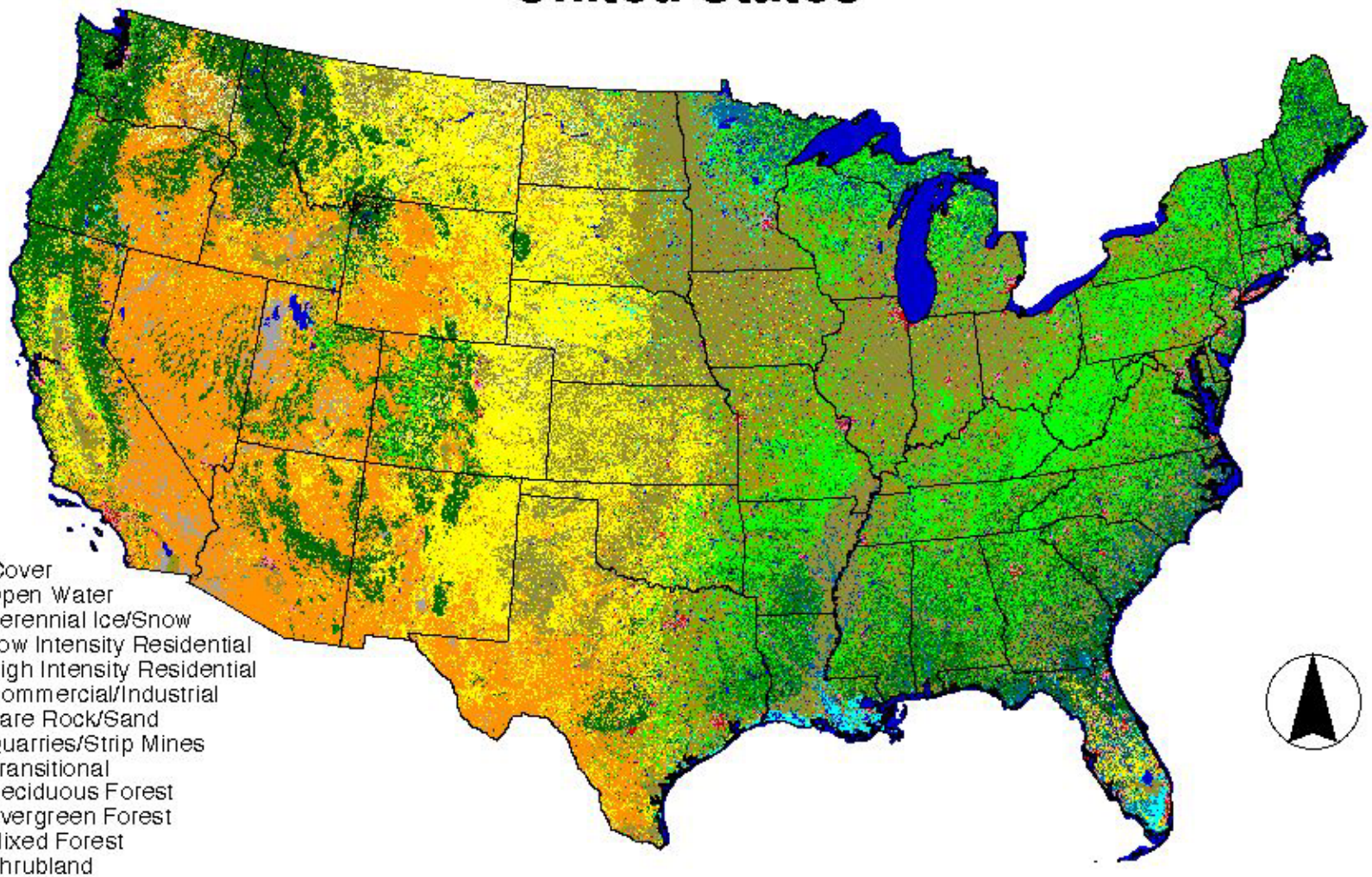
Land Use
Human Disturbance



Biological Condition
(e.g., species richness)


Natural variability
(stream size, complexity)
Land Use
Human Disturbance
Chemical Habitat
Physical Habitat
Biological Condition
(e.g., species richness)

MRLC Land Cover of the Conterminous United States



Land Cover
- Open Water
- Perennial Ice/Snow
- Low Intensity Residential
- High Intensity Residential
- Commercial/Industrial
- Bare Rock/Sand
- Quarries/Strip Mines
- Transitional
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrubland
- Orchards/Vineyards
- Grasslands/Herbaceous
- Pasture/Hay
- Row Crops
- Small Grains
- Fallow
- Urban Grasses
- Woody Wetlands
- Herbaceous Wetlands

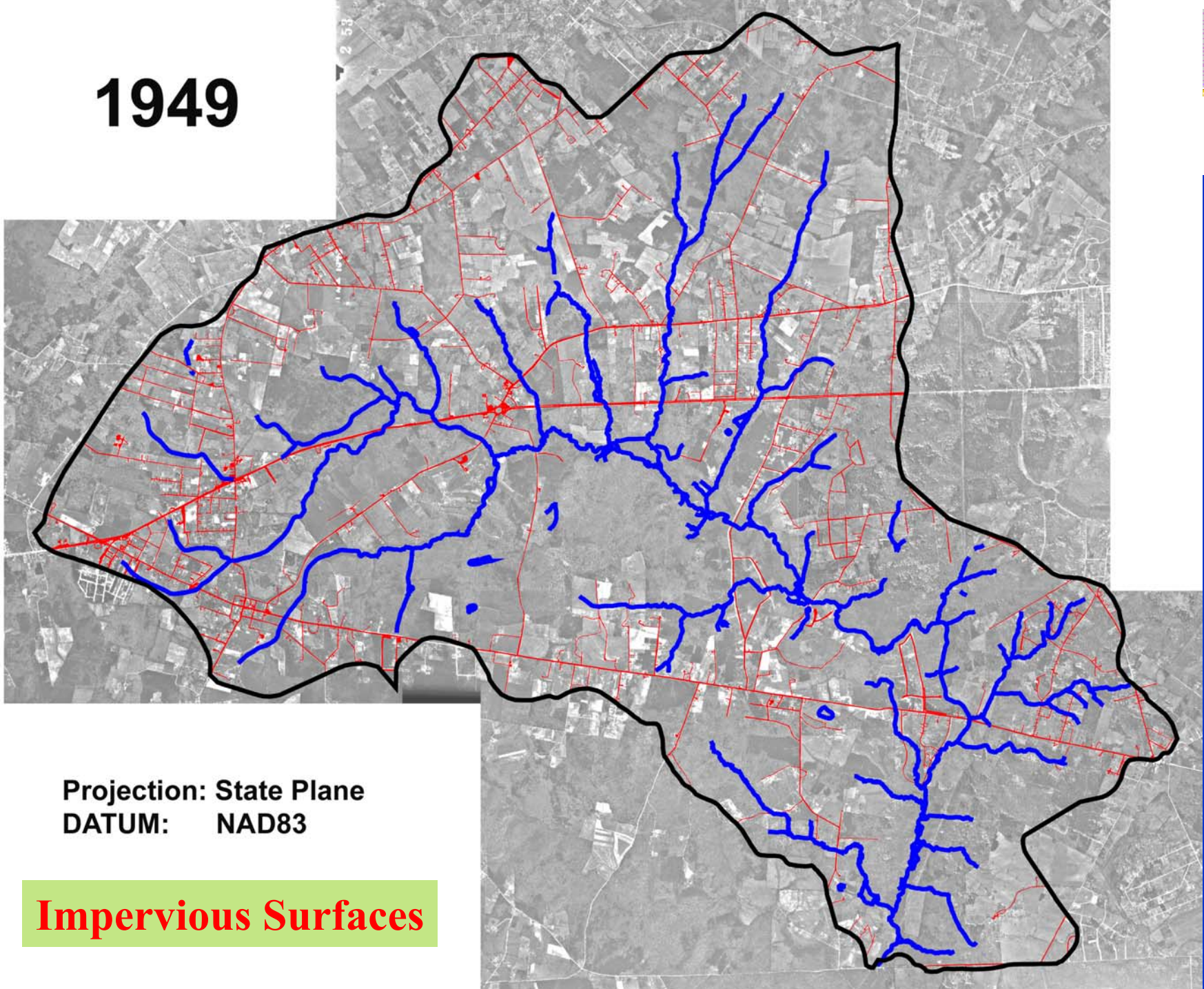
300 0 300 600 900

Kilometers

USGS

EPA

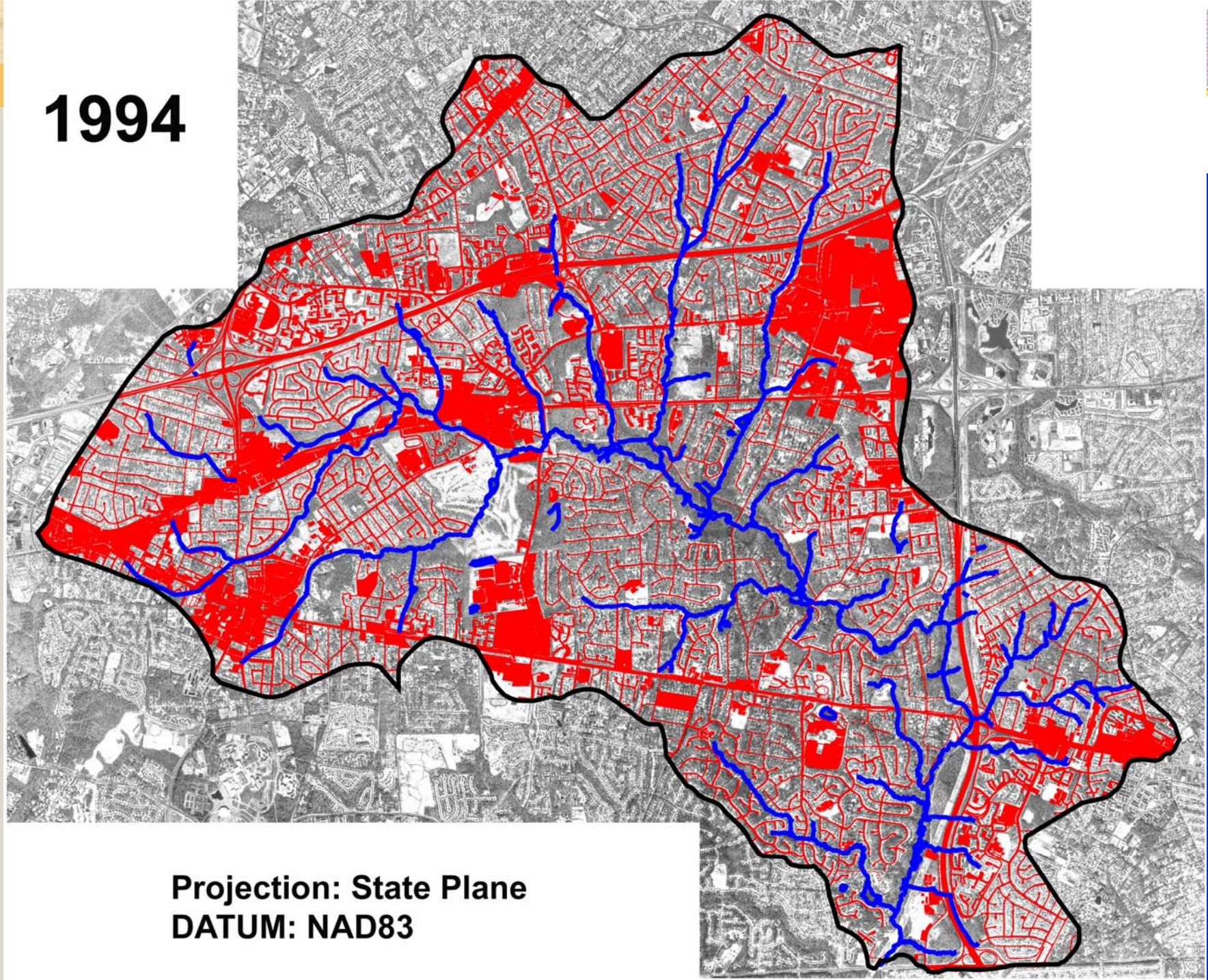
1949



Projection: State Plane
DATUM: NAD83

Impervious Surfaces

1994



Projection: State Plane
DATUM: NAD83

Survey Design

- How do we want to express results?
  - Length, Area, Number?
- How many “classes” of systems should we report on?
- How do we deal with intermittent/non-perennial systems
- How to use ecoregion, watershed and HUC concepts in concert?

MAHA Results: Aquatic Life Use Support Comparing 305(b) with 303(d)

	Current 305(b) Estimate (Non-Supporting)	305(b) Estimate (Non-S +Partially-S)	Current 303(d)
Pennsylvania	8,253	22,314	7,384
West Virginia	8,917	12,970	6,112

Linking 305(b) and 303(d)

- Have been focusing EMAP monitoring research on providing tools for effective 305(b) reporting
- How do we arrive at better “listing” or priority setting for “impaired” waters?

What comes next:

- Continue and Complete EMAP-West
- Begin Central Basin and Great Rivers
- Expand Research to Link 305(b) and 303(d) Needs
- Implement National Monitoring for those Resources Ready
- Don't Forget Other Resources, e.g., wetlands, lakes, intermittent systems
- Improve Assessments – Linkage of Conditions to Causes
- Integrate Remote Sensing, Survey and Research Tools

- Commitment to Viewing Monitoring as Critical to Effective Water Resource Management